

Session: Ongoing and Upcoming Mission Highlights

**MILANI LASER RETROREFLECTORS FOR HERA, ESA'S MISSION TO A
DOUBLE ASTEROID**

Simone Dell'Agnello⁽¹⁾, Marco Muccino⁽¹⁾⁽²⁾, Lorenzo Salvatori⁽¹⁾, Luciana Filomena⁽¹⁾, Matteo Petrassi⁽¹⁾, Michele Montanari⁽¹⁾, Alejandro Remujo-Castro⁽¹⁾

⁽¹⁾INFN-LNF (Frascati National Labs), Via E. Fermi 54, Frascati (RM) 00044, CP 13, Italy, +39-0694032730, simone.dellagnello@lnf.infn.it

⁽²⁾aeroTecno s.r.l., Via dei Savorelli 3, Rome (RM) 00165, Italy, +39-0694032780, marco.muccino@lnf.infn.it

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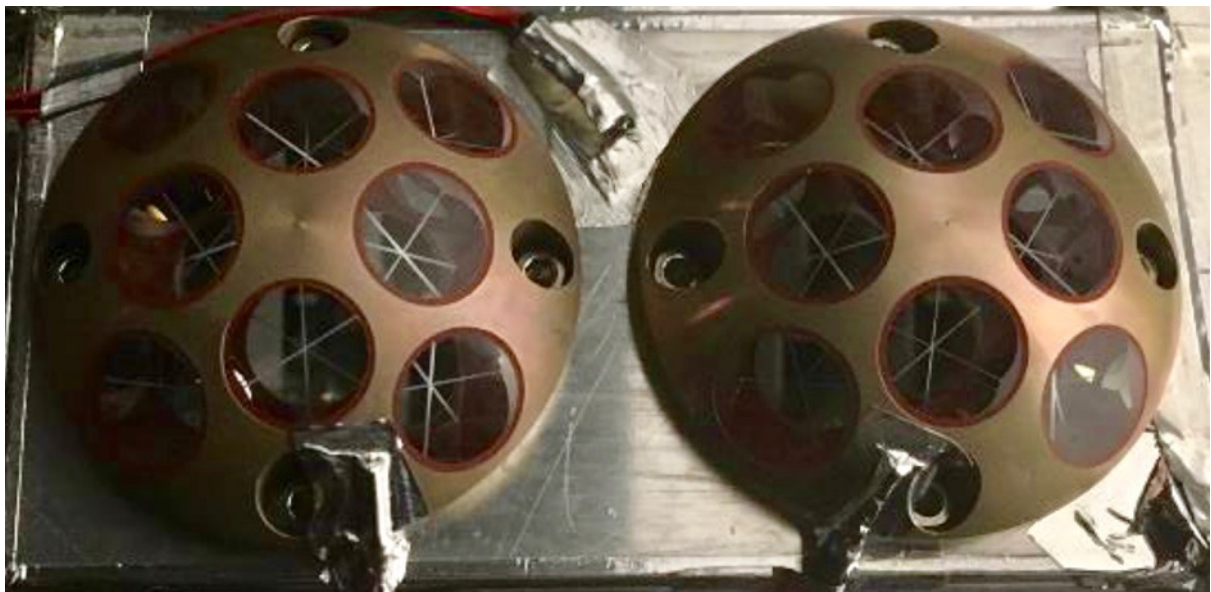
Extended ABSTRACT for poster presentation

INFN-LNF delivered to ESA through ASI two miniaturized laser retroreflectors dubbed INRRI (INstrument for landing-Roving laser Retroreflector Investigations) for the ExoMars Schiaparelli Lander in 2015 and for the ExoMars Rover mission in 2018. INFN-LNF also delivered to NASA-JPL through ASI the two other of these identical 'microreflectors' flown on the InSight Lander (LaRRI, Laser RetroReflector for InSight) in 2018 and on the Perseverance Rover (LaRA, Laser Retroreflector Array) in 2020. These four microreflectors are small spherical domes with eight laser retroreflectors of 0.5 inch diameter with total mass of 25 gr, circular base of 56 mm and 19 mm height. Exploiting this consolidated Mars heritage INFN developed custom, miniaturized reflector models for missions to other solar system destinations equipped with laser devices capable of laser altimetry and ranging. One of these mission is Hera by ESA (pursued through ASI), which will be launched in 2024 to the double asteroid Didymos and Dimorphos. Hera hosts several instruments to study and characterize the asteroids and their orbits, especially after the impact of NASA's DART. The mothership Hera will also carry two cubesat, one of which, named "Milani", will have onboard two Italian picoreflectors, named MLRH (Milani Laser Retroreflectors for Hera). The MLRH inherit directly from the very same Martial microreflector technology (figures attached). Milani is built as Prime Contractor by Tyvak International for ESA. The two MLRH are installed on two sides of Milani to be released in Didymos orbits by the Hera mothership equipped with a LIDAR instrument (LIght Detection And Ranging). The LIDAR will perform laser altimetry/topography of the asteroids and observe the MLRHs. Thus, asteroid metric observations by Milani will be metrically tied (georeferenced) by the LIDAR to the mothership and to the asteroids' topography. All Hera metric measurements will then have a highly accurate common georeference system thanks to the LIDAR and the MLRHs. Since the LIDAR observation distance will be shorter than for the heritage Mars missions, the MLRHs are more compact and light: they are built each with 7 reflectors of 7.16 mm diameter for a total mass of ~5.1 gr, 2D size of 36 mm and 10 mm height.

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The two MLRH picoreflectors for Hera.



The two INRRI microreflectors for ExoMars during the TVT test



LaRRI for Insight (left) and LaRA for Perseverance (right) microreflectors.